USDA GLOBAL CHANGE FACT SHEET

Greenhouse Gas Emissions and Agriculture

The concentration of greenhouse gases in the atmosphere has substantially increased since about 1850. A part of the total increase has been attributed to deforestation, conversion of forests, grasslands, and wetlands to cropland, and other agricultural activities.

Worldwide, the agriculture sector produces about 50 and 75 percent of anthropogenic methane (CH_4) and nitrous oxide (N_2O) emissions and about 5 percent of anthropogenic carbon dioxide (CO_2) emissions. Land use changes such as deforestation and biomass burning account for an additional 14 percent of total world emissions of CH_4, N_2O, and CO_2.

Agricultural activities contribute to greenhouse gas emissions directly and indirectly. Direct contributions result from emissions of CH_4, N_2O, and CO_2 are due to deforestation, biomass burning, ruminant animals, decomposition of soil organic carbon from tillage practices, rice cultivation, fertilizer application, use of manure, and degradation of wetlands. Plowing or soil turnover is the major cause of CO_2 emissions from cropland.

Indirect effects, which account for most of agricultural greenhouse gas emissions, are attributed to emissions of nitrous oxides and other gases from concentrated livestock operations and from microbial activities in soil and water following applications of fertilizers and manures.

In 1996, U.S. agricultural activities were responsible for 114 millions metric tons of carbon equivalent, or about 6 percent of total U.S. greenhouse gas emissions.

> **CO_2**. Agricultural activities contribute carbon dioxide emissions through combustion of fossil fuels, soil organic carbon decomposition, and biomass burning. Although the farm sector is energy-intensive, total energy use is small compared to other major industries. Carbon dioxide emissions from deforestation are not significant in the United States.
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> **CH_4**. Emissions of methane from agricultural activities come primarily from enteric fermentation in ruminant animals, rice cultivation, and biomass burning.
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> **N_2O**. Principal sources are soils, fertilizers and manures, and biomass burning.

USDA's global climate change research program focuses on: (1) improving measurements of greenhouse gas emissions from all human activities including deforestation, crop and livestock production, wetland conversions, and grazing of rangelands; (2) understanding the biological and physical mechanisms that produce those gases; (3) development of mitigation strategies that reduce emissions or sequester carbon; and (4) understanding the role of agricultural ecosystems in the global carbon cycle.

USDA also offers U.S. farmers education and programs to support nutrient planning:

- The *Ruminant Productivity* program—jointly administered by USDA and EPA—seeks to decrease rates of methane production by the digestive process of ruminant livestock like cattle. Because ruminant methane emission rates decline as quality of the diet improves, the program focuses on assisting livestock producers to provide forage of higher quality through improved forage production and grazing management.

- The *AgSTAR* program—also jointly administered by USDA and EPA—focuses on working with farmers on technologies that capture the methane released from manure management systems. The captured methane is an off-farm energy resource that can offset energy costs and increase bottom-line profits.

U.S. Greenhouse Emissions from the Agriculture Sector (Million Metric Tons Carbon Eequivalent)

Gas/Source	1990	1991	1992	1993	1994	1995	1996
CH_4	50.3	50.9	52.2	52.5	54.4	54.8	53.7
Enteric Fermentation	32.7	32.8	33.2	33.6	34.5	34.9	34.5
Manure Management	14.9	15.4	16.0	16.1	16.7	16.9	16.6
Rice Cultivation	2.5	2.5	2.8	2.5	3.0	2.8	2.5
Agricultural Residue	0.2	0.2	0.2	0.2	0.2	0.2	0.2
N_2O	55.4	56.5	57.1	58.5	60.4	59.7	60.3
Manure Management	3.3	3.5	3.5	3.6	3.7	3.6	3.7
Ag. Soil Management	52.0	52.9	53.5	54.8	56.6	55.9	56.5
Ag. Residue Burning	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total Ag. Emissions	**105.7**	**107.5**	**109.3**	**110.9**	**114.8**	**114.4**	**114.0**

Source: Draft 1998 Inventory of U.S. Greenhouse Gas Emissions and Sinks (1990-1996). http://www.epa.gov/globalwarming/inventory/1998-inv.html

To find out more about greenhouse gas emissions and agriculture:

Lal, R., .M. Kimble, R.F. Follett, and C.V. Cole. The Potential of U.S. Cropland to Sequester Carbon and Mitigate the Greenhouse Effect. Sleeping Bear Press, 1998.

Rayner, S., and E L. Malone (editors). Human Choice and Climate Change. Vol. 2, Resources and Technology. Battelle Press, 1998.

Watson, R T., M. C.. Zinyowera, R.H.. Moss, and D. J. Dokken (editors) Climate Change 1995, Impacts, Adaptation and Mitigation of Climate Change: Scientific-Technical Analyses. Intergovernmental Panel on Climate Change. Cambridge University Press, 1996.